

REMARKS/ARGUMENTS

Claims 7-10 and 14-18 are active in the case. Reconsideration is respectfully requested.

The present invention relates to a method of producing light hydrocarbons.

Claim Amendments

Claim 7 has been amended in order to limit the claimed process to one that is conducted in a fluidized bed-type reactor. Basis for the limitation can be found on page 6, lines 7-9 and page 8, line 25 of Example 1 of the claimed process. Accordingly, since the amendment to Claim 7 does not introduce new matter into the case, entry of the amendment into the record is respectfully requested.

Claim Rejection, 35 USC 103

Claims 7-10 and 14-18 stand rejected based on 35 USC 103(a) as obvious over JP 11-180902 in view of Friedrich et al U. S. Patent 3,669,877 and Miller et al, U. S. Patent 4,340,465. This ground of rejection is respectfully traversed.

Applicants retain their comments previously advanced on the record with respect to the cited '902 reference. The reference, in fact, describes a method of catalytically cracking hydrocarbon feed materials over a catalyst of a rare earth element supported on a zeolite. The objective is to prepare light olefins such as ethylene and propylene by a cracking reaction which achieves high selectivity to the light olefin materials. A preferred catalyst support is either ZSM-5 or ZSM-11. The reference in paragraph [0009] discloses that the reactor employed may contain a fixed bed or fluidized bed catalyst material. The reference therefore clearly teaches an equivalency between the two types of catalyst systems. However, the '902 reference provides no teachings or description of operational details of any fluidized bed

system. As applicants have previously stated, there are disadvantages inherent to the use of fluidized bed systems, this despite the fact as discussed in the book previously discussed and now presented in more formal form in the Rule 132 declaration enclosed. Even with advancements in the fluidized catalyst bed-technology, despite the fact that many fluidized bed systems have been constructed, the current state-of-the-art of the equipment of such systems is that the operation and maintenance of the systems has to be done empirically, and that criteria for the design and operation of such systems have not been firmly established. In the invention many difficulties have been encountered with the fluidized bed system in order to fix operational conditions. Accordingly, when a fluidized bed system is used for a new chemical reaction, the best way of operating such a system is accomplished by trial and error. When a different chemical reaction is investigated, the operational control conditions will be quite different.

With respect to the matter of the equivalency between the terms “weight percent” (disclosed in the ‘902 reference at paragraph [0009]) and “mass ratio” as used in lines 8-9 of present Claim 7 in expressing the relationship of steam to hydrocarbon mass as asserted by the Examiner at page 5, last full paragraph of the Office Action, the two expressions, in fact, are not equivalent or mean the same thing. The reference in paragraph [0009] discloses an amount of steam ranging from 0.1 to 1 wt % relative to the amount of hydrocarbon raw material fed to a reactor. However, this range of amount of steam when converted to a mass ratio, as stated in the present claims, is 0.001 to 0.01, i.e., (0.1/100 to 1/100). Thus, the mass ratio limitation of the present claims is substantially different from the range quoted in the ‘902 document. Clearly, the ‘902 document does not disclose or suggest the present invention.

Further commentary is necessary concerning the limitation in Claim 7 of “a catalyst to hydrocarbon mass ratio ranging from 18 to 40.” In Example 1 of the ‘902 reference,

normal butane as a raw material is described as a raw material that is used in a rate of 2.8 cc/min per 1 gram of catalyst. In other terms, the butane gas is supplied at a rate of 1.21×10^{-4} g/sec which is calculated as follows:

$$1.21 \times 10^{-4} \text{ (g/sec)} = 2.8 \text{ (ml/min)} / 22414 \text{ (ml/mol)} \times 58.12 \text{ (g/mol)} / 60 \text{ (sec/min)}$$

On the other hand, the contact time of hydrocarbon with the catalyst is calculated as 2.4 sec as shown below, in view of the consideration that the specific gravity of a zeolite catalyst is about 0.6, where the supply rates of butane, nitrogen and steam are calculated from the volume flow at a reaction temperature of 650° C, i.e.:

$$2.4 \text{ (sec)} = 1 \text{ g} / 0.6 \text{ (g/ml)} / (\text{supply rates of butane, nitrogen and steam in ml/sec}) = 1 \text{ (g)} / 0.6 \text{ (g/ml)} / (0.158 + 0.321 + 0.207 \text{ (ml/sec)}).$$

Thus, the catalyst to hydrocarbon (butane) mass ratio of Example 1 of the '902 document is 3,443 as calculated as follows:

$$3443 = 1 \text{ (g)} / (1.21 \times 10^{-4} \text{ (g/sec)} \times 2.4 \text{ (sec)})$$

This value is outside the range of 18 to 40 for the catalyst to hydrocarbon mass ratio set forth in Claim 7.

As stated in the previous response, when referring to the translation of sections of the book previously submitted and as now formally presented of record in the accompanying Rule 132 declaration, a fluidized catalyst bed is different from a fixed catalyst bed. Accordingly, a considerable degree of study into process conditions such as the catalyst/hydrocarbon ratio, because it is difficult to manipulate a fluidized bed. Applicants maintain their position as stated in the previous response with respect to the Friedrich et al and Miller et al patents. Since the disclosure of the primary '902 reference is believed to have been obviated, the obviousness rejection is believed to have been overcome and withdrawal of the same is respectfully requested.

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It is believed that the application is in proper condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, L.L.P.
Norman F. Oblon



Frederick D. Vastine, Ph.D.
Attorney of Record
Registration No. 27,013

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 07/09)